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**STORMWATER MANAGEMENT REPORT  
"GRISTMILL VILLAGE"  
DEFINITIVE PLAN  
CONVENTIONAL DEVELOPMENT  
GRAFTON, MASSACHUSETTS  
March 13, 2015  
Revised: December 16, 2015**

*Prepared for:*  
**CASA BUILDERS & DEVELOPERS CORP.  
P.O. BOX 1205  
WESTBOROUGH, MASSACHUSETTS 01581**

**RECEIVED**

**APR 11 2016**

*Prepared by:*  
**J.M. GRENIER ASSOCIATES INC.  
787 HARTFORD TURNPIKE  
SHREWSBURY, MA 01545**

**PLANNING BOARD  
GRAFTON, MA**



**Project Number:  
G-353  
Grafton, Massachusetts**

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# **DRAINAGE NARRATIVE**

## **Design Methods and Objectives**

The following drainage analysis has been prepared in accordance with the most current rules and regulations of the Town of Grafton, Massachusetts. Watershed areas were calculated for both the pre-development and post-development conditions. Existing and proposed ground cover conditions as well as terrain slopes were evaluated. Based upon the increased peak runoff from pre-development to the post development, storm water management systems were designed to attenuate the post development peak flows and runoff to be less than or equal to the pre-development rates of runoff. These calculations were performed using Hydrocad Stormwater Modeling Software for determining peak runoff and sizing detention/infiltration facilities for the 2, 10, 25 and 100 year storm event frequencies. Runoff hydrographs are calculated using the SCS Runoff equation and the SCS unitless hydrograph.

## **Existing Site Conditions**

The existing site conditions were analyzed to determine tributary site runoff areas, flow patterns, open space including wooded areas, as well as existing soil types. The drainage area that was analyzed includes the most of the existing site to the north of Pleasant Street and Grist Mill Road to be developed. The existing study area includes wooded/vegetated areas and lawn. The total tributary drainage area is 14.88 acres. The site does not contain any existing impervious area other than a limited area of ledge. The existing slopes on site range from 2-30%. The site currently drains towards Pleasant Street and Grist Mill Road to the south.

Existing soils located on site were determined to be Merrimac fine sandy loam, Canton fine sandy loam, Paxton sandy loam and Chatfield-Hollis-Rock outcrop complex. Merrimac is classified as Hydrologic Group A and has a drainage class rating of "somewhat excessively drained". Canton is classified as Hydrologic Group B and has a drainage class rating of "well drained". Paxton is classified as Hydrologic Group C and has a drainage class rating of "well drained". Chatfield-Hollis-Rock outcrop complex is classified as Hydrologic Group D and has a drainage class rating of "well drained to somewhat excessively drained". Included in Appendix C are soil log forms detailing our finding from on site soil testing performed at this site. This soil testing was used to verify the hydrologic group of the soils at the site and determine seasonal high groundwater levels as the drainage design includes infiltration.

## **Proposed Site Conditions**

In the post development condition, the property is proposed roadways, single family houses, driveways, lawn areas and stormwater management facilities associated with a 10 lot residential subdivision. The total impervious area in the post development condition is 1.48 acres. The total percentage of impervious area in the post development condition is 9.9%. The remaining portion of the site not developed is to remain wooded.

The proposed site drainage is separated into six subcatchment drainage areas. These subcatchments are physically separate in the post development condition through the use of an infiltration basin, a water quality inlet and subsurface recharge system. These methods are used in order to reduce peak runoff rates and treat runoff from developed paved areas in order to meet TSS removal requirements.

"Subcatchment P1" includes runoff from wooded areas to remain. This clean runoff flows toward Barbara Jean Street as it does in the existing condition.

"Subcatchment P2" includes runoff from lawn area and some wooded area to remain. This clean runoff is directed by a swale towards Grist Mill Road to the south

"Subcatchment P3" includes wooded areas and lawn. This clean runoff is directed by a swale toward the infiltration basin in order to attenuate peak rates of runoff toward Grist Mill Road.

“Subcatchment P4” includes Greystone Drive, houses, driveway and lawn areas. This runoff is directed to an infiltration basin at the southwestern corner of the site. The combination of a deep sump catch basin, and infiltration basin provides over 80% TSS removal.

“Subcatchment P5” includes wooden area and lawn runoff flowing overland toward Pleasant Street.

“Subcatchment P6” includes Millstone Drive and limited lawn area. This runoff is directed into a water quality inlet and subsurface recharge system near the intersection of Millstone Drive and Pleasant Drive. The combination of a deep sump catch basin, water quality inlet and subsurface recharge system provides over 80% TSS removal including 44% pretreatment.

The proposed drainage design for this development meets or exceeds all requirements by the Town of Grafton and the Department of Environmental Protection. As the calculations demonstrate the proposed drainage design provides attenuation of peak rates and volumes of runoff, improves the quality of site runoff that flows offsite by achieving a minimum of 80% TSS removal for paved areas. The drainage design as proposed will improve the quality of runoff that currently exists on this site.

## Drainage Analysis Summary

**Pre-Development Drainage Reach (1R) - Existing Conditions Site Runoff to Barabara Jean Street**

**Pre-Development Drainage Reach (2R) - Existing Conditions Site Runoff to Grist Mill Road**

**Pre-Development Drainage Reach (3R) - Existing Conditions Site Runoff to Pleasant Street**

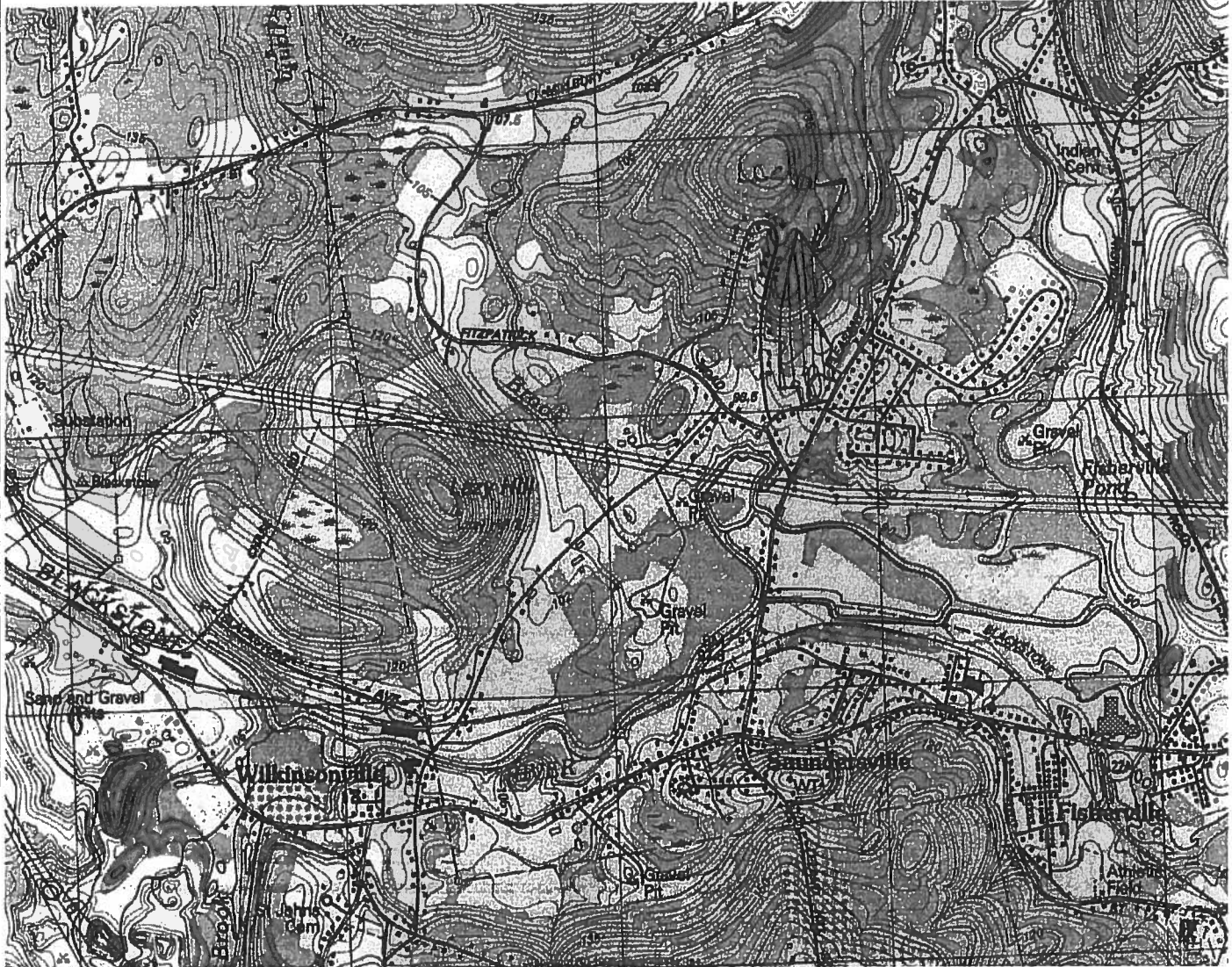
**Post-Development Drainage Reach (1R) - Post development runoff to Barbara Jean Street  
Post Development Drainage Area (P1)**

**Post-Development Drainage Reach (2R) - Combined post development runoff to Grist Mill Road  
Post Development Drainage Areas (P2,P3,P4)**

**Post-Development Drainage Reach (3R) - Combined post development runoff to Pleasant Street  
Post Development Drainage Areas (P5,P6)**

**Note: (Peak Flow Rate in cfs)**

	<u><b>2 Year</b></u>	<u><b>10 Year</b></u>	<u><b>25 Year</b></u>	<u><b>100 Year</b></u>
<b>Storm Intensity</b>	<b>3.24 inches</b>	<b>4.89 inches</b>	<b>6.18 inches</b>	<b>8.85 inches</b>
<b>Pre-Development (1R) To Barbara Jean Street</b>	<b>2.62</b>	<b>6.38</b>	<b>9.69</b>	<b>17.01</b>
<b>Pre-Development (2R) To Grist Mill Road</b>	<b>0.75</b>	<b>3.83</b>	<b>7.22</b>	<b>15.67</b>
<b>Pre-Development (3R) To Pleasant Street</b>	<b>2.19</b>	<b>6.32</b>	<b>10.16</b>	<b>18.94</b>
<b>Post-Development (P1)</b>	<b>2.62</b>	<b>6.38</b>	<b>9.69</b>	<b>17.01</b>
<b>Post-Development (1R) To Barbara Jean Street</b>	<b>2.62</b>	<b>6.38</b>	<b>9.69</b>	<b>17.01</b>
<b>Post-Development (P2)</b>	<b>0.36</b>	<b>1.57</b>	<b>2.84</b>	<b>5.91</b>
<b>Post-Development (P3,P4 Routed Through Basin)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>5.48</b>
<b>Post-Development (2R) To Grist Mill Road</b>	<b>0.36</b>	<b>1.57</b>	<b>2.84</b>	<b>11.24</b>
<b>Post-Development (P5)</b>	<b>1.09</b>	<b>3.18</b>	<b>5.11</b>	<b>9.52</b>
<b>Post-Development (P6 Routed Through Recharge)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Post-Development (3R) To Pleasant Street</b>	<b>1.09</b>	<b>3.18</b>	<b>5.11</b>	<b>9.52</b>
<b>Reduction From Pre- to Post-Development (1R)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Reduction From Pre- to Post-Development (2R)</b>	<b>-0.39</b>	<b>-2.26</b>	<b>-4.38</b>	<b>-4.43</b>
<b>Reduction From Pre- to Post-Development (3R)</b>	<b>-1.10</b>	<b>-3.45</b>	<b>-5.05</b>	<b>-9.42</b>



## LOCUS PLAN

Source: USGS Quadrangles for  
Milford, MA  
7.5 x 15 minute series (metric)  
Scale: 1:25,000 or 1" = 2083.33'

4 Grist Mill Road & 102 Pleasant Street  
Grafton, Massachusetts

Prepared by: J.M. GRENIER ASSOCIATES INC - Shrewsbury, MA



Runoff to Barbara Jean  
St



Barbara Jean St



Runoff to Grist Mill Rd



Grist Mill Rd



Runoff to Pleasant St



Pleasant St



**Drainage Diagram for G-353-PRE-12-11-15**

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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.130	30	Woods, Good, HSG A (E2,E3)
0.150	32	Woods/grass comb., Good, HSG A (E2)
3.840	55	Woods, Good, HSG B (E1,E2,E3)
1.970	58	Woods/grass comb., Good, HSG B (E2,E3)
2.860	61	Lawn, Good, HSG B (E2,E3)
2.020	70	Woods, Good, HSG C (E1,E3)
3.850	77	Woods, Good, HSG D (E1,E2,E3)
0.060	98	Ledge (E2)
<b>14.880</b>		<b>TOTAL AREA</b>



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## **PRE DEVELOPMENT 2 YEAR STORM EVENT**

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**G-353-PRE-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>0.81"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=2.62 cfs 0.256 af

**Subcatchment E2: Runoff to Grist Mill Rd** Runoff Area=5.470 ac 1.10% Impervious Runoff Depth>0.27"  
Flow Length=809' Tc=18.8 min CN=57 Runoff=0.75 cfs 0.125 af

**Subcatchment E3: Runoff to Pleasant St** Runoff Area=5.630 ac 0.00% Impervious Runoff Depth>0.59"  
Flow Length=1,224' Tc=25.3 min CN=66 Runoff=2.19 cfs 0.275 af

**Reach 1R: Barbara Jean St**Inflow=2.62 cfs 0.256 af  
Outflow=2.62 cfs 0.256 af**Reach 2R: Grist Mill Rd**Inflow=0.75 cfs 0.125 af  
Outflow=0.75 cfs 0.125 af**Reach 3R: Pleasant St**Inflow=2.19 cfs 0.275 af  
Outflow=2.19 cfs 0.275 af

**Total Runoff Area = 14.880 ac Runoff Volume = 0.656 af Average Runoff Depth = 0.53"**  
**99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac**

**Summary for Subcatchment E1: Runoff to Barbara Jean St**

Runoff = 2.62 cfs @ 12.26 hrs, Volume= 0.256 af, Depth&gt; 0.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b>
					Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b>
					Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment E2: Runoff to Grist Mill Rd**

Runoff = 0.75 cfs @ 12.48 hrs, Volume= 0.125 af, Depth&gt; 0.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
0.320	77	Woods, Good, HSG D
2.770	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.950	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 0.190	61	Lawn, Good, HSG B
5.470	57	Weighted Average
5.410		Pervious Area
0.060		Impervious Area

**G-353-PRE-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	200	0.1300	1.80		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
1.6	119	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
2.6	106	0.0190	0.69		<b>Shallow Concentrated Flow, Segment 4</b> Woodland Kv= 5.0 fps
6.1	334	0.0170	0.91		<b>Shallow Concentrated Flow, Segment 5</b> Short Grass Pasture Kv= 7.0 fps
18.8	809	Total			

**Summary for Subcatchment E3: Runoff to Pleasant St**

Runoff = 2.19 cfs @ 12.43 hrs, Volume= 0.275 af, Depth&gt; 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
0.920	70	Woods, Good, HSG C
1.540	77	Woods, Good, HSG D
0.380	55	Woods, Good, HSG B
0.100	30	Woods, Good, HSG A
0.020	58	Woods/grass comb., Good, HSG B
* 2.670	61	Lawn, Good, HSG B
5.630	66	Weighted Average
5.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		<b>Shallow Concentrated Flow, Segment 3</b> Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		<b>Shallow Concentrated Flow, Segment 4</b> Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 0.81" for 2-YR event  
 Inflow = 2.62 cfs @ 12.26 hrs, Volume= 0.256 af  
 Outflow = 2.62 cfs @ 12.26 hrs, Volume= 0.256 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 5.470 ac, 1.10% Impervious, Inflow Depth > 0.27" for 2-YR event  
Inflow = 0.75 cfs @ 12.48 hrs, Volume= 0.125 af  
Outflow = 0.75 cfs @ 12.48 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 5.630 ac, 0.00% Impervious, Inflow Depth > 0.59" for 2-YR event  
Inflow = 2.19 cfs @ 12.43 hrs, Volume= 0.275 af  
Outflow = 2.19 cfs @ 12.43 hrs, Volume= 0.275 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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**PRE DEVELOPMENT 10 YEAR STORM EVENT**

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**G-353-PRE-12-11-15**

Type III 24-hr 10-YR Rainfall=4.89"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>1.87"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=6.38 cfs 0.588 af

**Subcatchment E2: Runoff to Grist Mill Rd** Runoff Area=5.470 ac 1.10% Impervious Runoff Depth>0.93"  
Flow Length=809' Tc=18.8 min CN=57 Runoff=3.83 cfs 0.424 af

**Subcatchment E3: Runoff to Pleasant St** Runoff Area=5.630 ac 0.00% Impervious Runoff Depth>1.50"  
Flow Length=1,224' Tc=25.3 min CN=66 Runoff=6.32 cfs 0.703 af

**Reach 1R: Barbara Jean St**Inflow=6.38 cfs 0.588 af  
Outflow=6.38 cfs 0.588 af**Reach 2R: Grist Mill Rd**Inflow=3.83 cfs 0.424 af  
Outflow=3.83 cfs 0.424 af**Reach 3R: Pleasant St**Inflow=6.32 cfs 0.703 af  
Outflow=6.32 cfs 0.703 af

**Total Runoff Area = 14.880 ac Runoff Volume = 1.714 af Average Runoff Depth = 1.38"**  
**99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac**

**Summary for Subcatchment E1: Runoff to Barbara Jean St**

Runoff = 6.38 cfs @ 12.24 hrs, Volume= 0.588 af, Depth> 1.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment E2: Runoff to Grist Mill Rd**

Runoff = 3.83 cfs @ 12.31 hrs, Volume= 0.424 af, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
0.320	77	Woods, Good, HSG D
2.770	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.950	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 0.190	61	Lawn, Good, HSG B
5.470	57	Weighted Average
5.410		Pervious Area
0.060		Impervious Area



**G-353-PRE-12-11-15**

Type III 24-hr 10-YR Rainfall=4.89"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	200	0.1300	1.80		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
1.6	119	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
2.6	106	0.0190	0.69		<b>Shallow Concentrated Flow, Segment 4</b> Woodland Kv= 5.0 fps
6.1	334	0.0170	0.91		<b>Shallow Concentrated Flow, Segment 5</b> Short Grass Pasture Kv= 7.0 fps
18.8	809	Total			

**Summary for Subcatchment E3: Runoff to Pleasant St**

Runoff = 6.32 cfs @ 12.38 hrs, Volume= 0.703 af, Depth&gt; 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
0.920	70	Woods, Good, HSG C
1.540	77	Woods, Good, HSG D
0.380	55	Woods, Good, HSG B
0.100	30	Woods, Good, HSG A
0.020	58	Woods/grass comb., Good, HSG B
* 2.670	61	Lawn, Good, HSG B
5.630	66	Weighted Average
5.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		<b>Shallow Concentrated Flow, Segment 3</b> Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		<b>Shallow Concentrated Flow, Segment 4</b> Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 1.87" for 10-YR event  
 Inflow = 6.38 cfs @ 12.24 hrs, Volume= 0.588 af  
 Outflow = 6.38 cfs @ 12.24 hrs, Volume= 0.588 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 5.470 ac, 1.10% Impervious, Inflow Depth > 0.93" for 10-YR event  
Inflow = 3.83 cfs @ 12.31 hrs, Volume= 0.424 af  
Outflow = 3.83 cfs @ 12.31 hrs, Volume= 0.424 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 5.630 ac, 0.00% Impervious, Inflow Depth > 1.50" for 10-YR event  
Inflow = 6.32 cfs @ 12.38 hrs, Volume= 0.703 af  
Outflow = 6.32 cfs @ 12.38 hrs, Volume= 0.703 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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## **PRE DEVELOPMENT 25 YEAR STORM EVENT**

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**G-353-PRE-12-11-15**

Type III 24-hr 25-YR Rainfall=6.18"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>2.81"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=9.69 cfs 0.887 af

**Subcatchment E2: Runoff to Grist Mill Rd** Runoff Area=5.470 ac 1.10% Impervious Runoff Depth>1.61"  
Flow Length=809' Tc=18.8 min CN=57 Runoff=7.22 cfs 0.734 af

**Subcatchment E3: Runoff to Pleasant St** Runoff Area=5.630 ac 0.00% Impervious Runoff Depth>2.35"  
Flow Length=1,224' Tc=25.3 min CN=66 Runoff=10.16 cfs 1.105 af

**Reach 1R: Barbara Jean St**Inflow=9.69 cfs 0.887 af  
Outflow=9.69 cfs 0.887 af**Reach 2R: Grist Mill Rd**Inflow=7.22 cfs 0.734 af  
Outflow=7.22 cfs 0.734 af**Reach 3R: Pleasant St**Inflow=10.16 cfs 1.105 af  
Outflow=10.16 cfs 1.105 af

**Total Runoff Area = 14.880 ac Runoff Volume = 2.726 af Average Runoff Depth = 2.20"**  
**99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac**

**Summary for Subcatchment E1: Runoff to Barbara Jean St**

Runoff = 9.69 cfs @ 12.24 hrs, Volume= 0.887 af, Depth&gt; 2.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b>
					Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b>
					Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment E2: Runoff to Grist Mill Rd**

Runoff = 7.22 cfs @ 12.29 hrs, Volume= 0.734 af, Depth&gt; 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
0.320	77	Woods, Good, HSG D
2.770	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.950	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 0.190	61	Lawn, Good, HSG B
5.470	57	Weighted Average
5.410		Pervious Area
0.060		Impervious Area

**G-353-PRE-12-11-15**

Type III 24-hr 25-YR Rainfall=6.18"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	200	0.1300	1.80		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
1.6	119	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
2.6	106	0.0190	0.69		<b>Shallow Concentrated Flow, Segment 4</b> Woodland Kv= 5.0 fps
6.1	334	0.0170	0.91		<b>Shallow Concentrated Flow, Segment 5</b> Short Grass Pasture Kv= 7.0 fps
18.8	809	Total			

**Summary for Subcatchment E3: Runoff to Pleasant St**

Runoff = 10.16 cfs @ 12.37 hrs, Volume= 1.105 af, Depth&gt; 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
0.920	70	Woods, Good, HSG C
1.540	77	Woods, Good, HSG D
0.380	55	Woods, Good, HSG B
0.100	30	Woods, Good, HSG A
0.020	58	Woods/grass comb., Good, HSG B
* 2.670	61	Lawn, Good, HSG B
5.630	66	Weighted Average
5.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		<b>Shallow Concentrated Flow, Segment 3</b> Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		<b>Shallow Concentrated Flow, Segment 4</b> Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 2.81" for 25-YR event  
 Inflow = 9.69 cfs @ 12.24 hrs, Volume= 0.887 af  
 Outflow = 9.69 cfs @ 12.24 hrs, Volume= 0.887 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 5.470 ac, 1.10% Impervious, Inflow Depth > 1.61" for 25-YR event  
Inflow = 7.22 cfs @ 12.29 hrs, Volume= 0.734 af  
Outflow = 7.22 cfs @ 12.29 hrs, Volume= 0.734 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 5.630 ac, 0.00% Impervious, Inflow Depth > 2.35" for 25-YR event  
Inflow = 10.16 cfs @ 12.37 hrs, Volume= 1.105 af  
Outflow = 10.16 cfs @ 12.37 hrs, Volume= 1.105 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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## PRE DEVELOPMENT 100 YEAR STORM EVENT

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**G-353-PRE-12-11-15**

Type III 24-hr 100-YR Rainfall=8.85"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>4.97"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=17.01 cfs 1.564 af

**Subcatchment E2: Runoff to Grist Mill Rd** Runoff Area=5.470 ac 1.10% Impervious Runoff Depth>3.32"  
Flow Length=809' Tc=18.8 min CN=57 Runoff=15.67 cfs 1.512 af

**Subcatchment E3: Runoff to Pleasant St** Runoff Area=5.630 ac 0.00% Impervious Runoff Depth>4.36"  
Flow Length=1,224' Tc=25.3 min CN=66 Runoff=18.94 cfs 2.045 af

**Reach 1R: Barbara Jean St**  
Inflow=17.01 cfs 1.564 af  
Outflow=17.01 cfs 1.564 af

**Reach 2R: Grist Mill Rd**  
Inflow=15.67 cfs 1.512 af  
Outflow=15.67 cfs 1.512 af

**Reach 3R: Pleasant St**  
Inflow=18.94 cfs 2.045 af  
Outflow=18.94 cfs 2.045 af

**Total Runoff Area = 14.880 ac Runoff Volume = 5.122 af Average Runoff Depth = 4.13"**  
**99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac**

**Summary for Subcatchment E1: Runoff to Barbara Jean St**

Runoff = 17.01 cfs @ 12.23 hrs, Volume= 1.564 af, Depth> 4.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b>
					Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b>
					Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment E2: Runoff to Grist Mill Rd**

Runoff = 15.67 cfs @ 12.27 hrs, Volume= 1.512 af, Depth> 3.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
0.320	77	Woods, Good, HSG D
2.770	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.950	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 0.190	61	Lawn, Good, HSG B
5.470	57	Weighted Average
5.410		Pervious Area
0.060		Impervious Area

**G-353-PRE-12-11-15**

Type III 24-hr 100-YR Rainfall=8.85"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.8	200	0.1300	1.80		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
1.6	119	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
2.6	106	0.0190	0.69		<b>Shallow Concentrated Flow, Segment 4</b> Woodland Kv= 5.0 fps
6.1	334	0.0170	0.91		<b>Shallow Concentrated Flow, Segment 5</b> Short Grass Pasture Kv= 7.0 fps
18.8	809	Total			

**Summary for Subcatchment E3: Runoff to Pleasant St**

Runoff = 18.94 cfs @ 12.36 hrs, Volume= 2.045 af, Depth&gt; 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
0.920	70	Woods, Good, HSG C
1.540	77	Woods, Good, HSG D
0.380	55	Woods, Good, HSG B
0.100	30	Woods, Good, HSG A
0.020	58	Woods/grass comb., Good, HSG B
* 2.670	61	Lawn, Good, HSG B
5.630	66	Weighted Average
5.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		<b>Shallow Concentrated Flow, Segment 3</b> Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		<b>Shallow Concentrated Flow, Segment 4</b> Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 4.97" for 100-YR event  
 Inflow = 17.01 cfs @ 12.23 hrs, Volume= 1.564 af  
 Outflow = 17.01 cfs @ 12.23 hrs, Volume= 1.564 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### **Summary for Reach 2R: Grist Mill Rd**

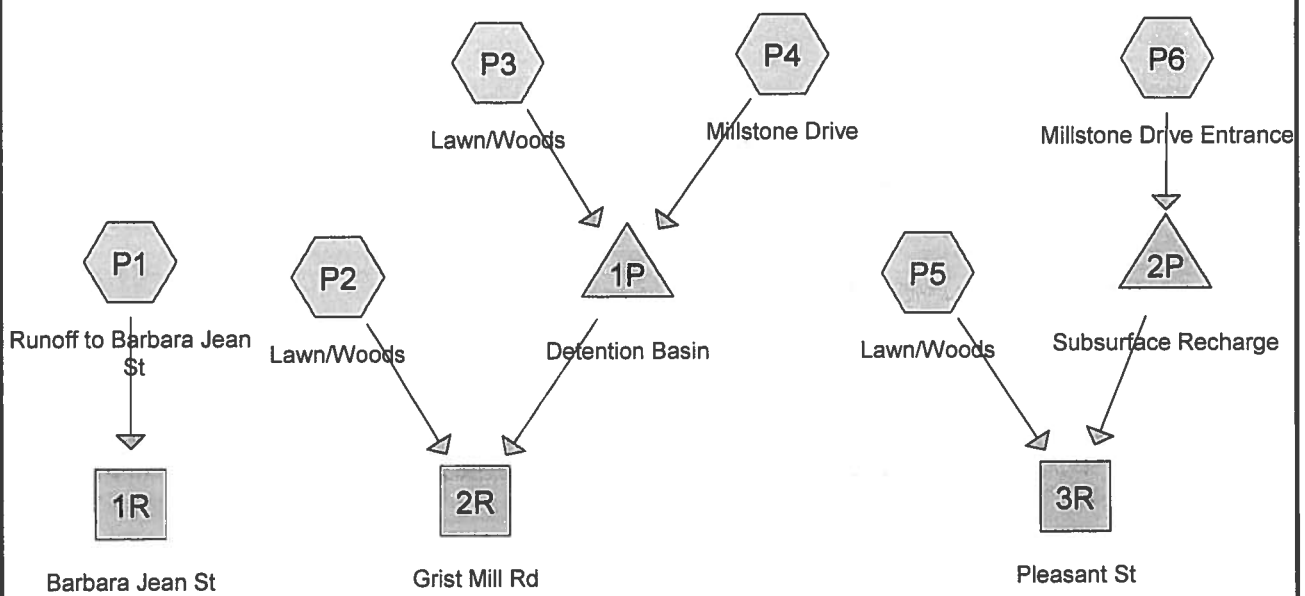
Inflow Area = 5.470 ac, 1.10% Impervious, Inflow Depth > 3.32" for 100-YR event  
Inflow = 15.67 cfs @ 12.27 hrs, Volume= 1.512 af  
Outflow = 15.67 cfs @ 12.27 hrs, Volume= 1.512 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### **Summary for Reach 3R: Pleasant St**

Inflow Area = 5.630 ac, 0.00% Impervious, Inflow Depth > 4.36" for 100-YR event  
Inflow = 18.94 cfs @ 12.36 hrs, Volume= 2.045 af  
Outflow = 18.94 cfs @ 12.36 hrs, Volume= 2.045 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



**Drainage Diagram for G-353-POST-12-11-15**  
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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.030	30	Woods, Good, HSG A (P2)
0.200	39	Lawn, Good, HSG A (P2,P6)
2.190	55	Woods, Good, HSG B (P1,P2,P3,P5)
5.650	61	Lawn, Good, HSG B (P2,P3,P4,P5,P6)
1.480	70	Woods, Good, HSG C (P1,P5)
3.680	77	Woods, Good, HSG D (P1,P3,P5)
0.170	80	Lawn, Good, HSG D (P3)
1.420	98	Impervious (P4,P6)
0.060	98	Ledge (P2)
<b>14.880</b>		<b>TOTAL AREA</b>

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## POST DEVELOPMENT 2 YEAR STORM EVENT

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**G-353-POST-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>0.81"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=2.62 cfs 0.256 af

**Subcatchment P2: Lawn/Woods** Runoff Area=1.900 ac 3.16% Impervious Runoff Depth>0.33"  
Flow Length=485' Tc=18.3 min CN=59 Runoff=0.36 cfs 0.053 af

**Subcatchment P3: Lawn/Woods** Runoff Area=3.050 ac 0.00% Impervious Runoff Depth>0.55"  
Flow Length=901' Tc=9.9 min CN=65 Runoff=1.51 cfs 0.140 af

**Subcatchment P4: Millstone Drive** Runoff Area=3.240 ac 38.58% Impervious Runoff Depth>1.02"  
Flow Length=647' Tc=9.4 min CN=75 Runoff=3.58 cfs 0.276 af

**Subcatchment P5: Lawn/Woods** Runoff Area=2.590 ac 0.00% Impervious Runoff Depth>0.59"  
Flow Length=819' Tc=20.4 min CN=66 Runoff=1.09 cfs 0.127 af

**Subcatchment P6: Millstone Drive Entrance** Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>1.14"  
Flow Length=325' Tc=5.7 min CN=77 Runoff=0.45 cfs 0.030 af

**Reach 1R: Barbara Jean St** Inflow=2.62 cfs 0.256 af  
Outflow=2.62 cfs 0.256 af

**Reach 2R: Grist Mill Rd** Inflow=0.36 cfs 0.053 af  
Outflow=0.36 cfs 0.053 af

**Reach 3R: Pleasant St** Inflow=1.09 cfs 0.127 af  
Outflow=1.09 cfs 0.127 af

**Pond 1P: Detention Basin** Peak Elev=329.97' Storage=7,092 cf Inflow=5.06 cfs 0.416 af  
Discarded=0.75 cfs 0.390 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.75 cfs 0.390 af

**Pond 2P: Subsurface Recharge** Peak Elev=328.32' Storage=276 cf Inflow=0.45 cfs 0.030 af  
Discarded=0.14 cfs 0.030 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.030 af

**Total Runoff Area = 14.880 ac Runoff Volume = 0.882 af Average Runoff Depth = 0.71"**  
**90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac**



**Summary for Subcatchment P1: Runoff to Barbara Jean St**

Runoff = 2.62 cfs @ 12.26 hrs, Volume= 0.256 af, Depth> 0.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment P2: Lawn/Woods**

Runoff = 0.36 cfs @ 12.42 hrs, Volume= 0.053 af, Depth> 0.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
0.320	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 1.340	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
1.900	59	Weighted Average
1.840		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.22		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
14.6	435	0.0050	0.49		<b>Shallow Concentrated Flow, Segment 2</b> Short Grass Pasture Kv= 7.0 fps
18.3	485	Total			

**G-353-POST-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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**Summary for Subcatchment P3: Lawn/Woods**

Runoff = 1.51 cfs @ 12.17 hrs, Volume= 0.140 af, Depth&gt; 0.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
0.910	77	Woods, Good, HSG D
0.710	55	Woods, Good, HSG B
* 0.170	80	Lawn, Good, HSG D
* 1.260	61	Lawn, Good, HSG B
3.050	65	Weighted Average
3.050		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	222	0.2070	2.27		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	<b>Trap/Vee/Rect Channel Flow, Segment 4</b> Bot.W=5.00' D=2.00' Z= 3.0 ' Top.W=17.00' n= 0.033
0.2	40	0.3300	4.02		<b>Shallow Concentrated Flow, Segment 6</b> Short Grass Pasture Kv= 7.0 fps
9.9	901	Total			

**Summary for Subcatchment P4: Millstone Drive**

Runoff = 3.58 cfs @ 12.15 hrs, Volume= 0.276 af, Depth&gt; 1.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
* 1.990	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.240	75	Weighted Average
1.990		Pervious Area
1.250		Impervious Area

**G-353-POST-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		<b>Shallow Concentrated Flow, Segment 2</b> Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 4</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

**Summary for Subcatchment P5: Lawn/Woods**

Runoff = 1.09 cfs @ 12.34 hrs, Volume= 0.127 af, Depth&gt; 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

Area (ac)	CN	Description
0.380	70	Woods, Good, HSG C
0.780	77	Woods, Good, HSG D
0.470	55	Woods, Good, HSG B
* 0.960	61	Lawn, Good, HSG B
2.590	66	Weighted Average
2.590		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
4.6	530	0.1470	1.92		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.1	239	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
20.4	819	Total			

**Summary for Subcatchment P6: Millstone Drive Entrance**

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.030 af, Depth&gt; 1.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.24"

**G-353-POST-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		<b>Sheet Flow, Segment 2</b> Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 3</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 0.81" for 2-YR event  
 Inflow = 2.62 cfs @ 12.26 hrs, Volume= 0.256 af  
 Outflow = 2.62 cfs @ 12.26 hrs, Volume= 0.256 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 8.190 ac, 16.00% Impervious, Inflow Depth > 0.08" for 2-YR event  
 Inflow = 0.36 cfs @ 12.42 hrs, Volume= 0.053 af  
 Outflow = 0.36 cfs @ 12.42 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 2.910 ac, 5.84% Impervious, Inflow Depth > 0.52" for 2-YR event  
 Inflow = 1.09 cfs @ 12.34 hrs, Volume= 0.127 af  
 Outflow = 1.09 cfs @ 12.34 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Pond 1P: Detention Basin**

Inflow Area = 6.290 ac, 19.87% Impervious, Inflow Depth > 0.79" for 2-YR event  
 Inflow = 5.06 cfs @ 12.15 hrs, Volume= 0.416 af  
 Outflow = 0.75 cfs @ 13.11 hrs, Volume= 0.390 af, Atten= 85%, Lag= 57.1 min  
 Discarded = 0.75 cfs @ 13.11 hrs, Volume= 0.390 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 329.97' @ 13.11 hrs Surf.Area= 13,398 sf Storage= 7,092 cf

Plug-Flow detention time= 121.7 min calculated for 0.390 af (94% of inflow)  
 Center-of-Mass det. time= 100.0 min ( 926.9 - 826.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	329.00'	99,247 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	1,187	0	0
330.00	13,743	7,465	7,465
332.00	17,549	31,292	38,757
334.00	21,044	38,593	77,350
335.00	22,749	21,897	99,247

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	<b>12.0" x 156.0' long Culvert</b> RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 327.22' S= 0.0050 '/' Cc= 0.900 n= 0.013
#2	Device 1	332.00'	<b>2.00' x 2.00' Horiz. Orifice/Grate</b> Limited to weir flow C= 0.600
#3	Secondary	334.50'	<b>15.0' long x 15.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Discarded	329.00'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.75 cfs @ 13.11 hrs HW=329.97' (Free Discharge)

↑ **4=Exfiltration** (Exfiltration Controls 0.75 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↑ **1=Culvert** (Passes 0.00 cfs of 2.32 cfs potential flow)

↑ **2=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**G-353-POST-12-11-15**

Type III 24-hr 2-YR Rainfall=3.24"

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**Summary for Pond 2P: Subsurface Recharge**

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 1.14" for 2-YR event  
 Inflow = 0.45 cfs @ 12.09 hrs, Volume= 0.030 af  
 Outflow = 0.14 cfs @ 12.00 hrs, Volume= 0.030 af, Atten= 69%, Lag= 0.0 min  
 Discarded = 0.14 cfs @ 12.00 hrs, Volume= 0.030 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 328.32' @ 12.46 hrs Surf.Area= 2,520 sf Storage= 276 cf

Plug-Flow detention time= 13.7 min calculated for 0.030 af (100% of inflow)  
 Center-of-Mass det. time= 12.8 min ( 823.1 - 810.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	328.05'	3,832 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 11,340 cf Overall - 1,760 cf Embedded = 9,580 cf x 40.0% Voids
#2	329.70'	782 cf	<b>12.0"D x 166.00'L Horizontal Cylinder</b> x 6 Inside #1 1,760 cf Overall - 3.0" Wall Thickness = 782 cf
		4,614 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.05	2,520	0	0
332.55	2,520	11,340	11,340

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.05'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	332.50'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.14 cfs @ 12.00 hrs HW=328.10' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.05' (Free Discharge)

↳ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**G-353-POST-12-11-15**

Type III 24-hr 10-YR Rainfall=4.89"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>1.87"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=6.38 cfs 0.588 af

**Subcatchment P2: Lawn/Woods** Runoff Area=1.900 ac 3.16% Impervious Runoff Depth>1.05"  
Flow Length=485' Tc=18.3 min CN=59 Runoff=1.57 cfs 0.166 af

**Subcatchment P3: Lawn/Woods** Runoff Area=3.050 ac 0.00% Impervious Runoff Depth>1.44"  
Flow Length=901' Tc=9.9 min CN=65 Runoff=4.63 cfs 0.366 af

**Subcatchment P4: Millstone Drive** Runoff Area=3.240 ac 38.58% Impervious Runoff Depth>2.19"  
Flow Length=647' Tc=9.4 min CN=75 Runoff=7.83 cfs 0.590 af

**Subcatchment P5: Lawn/Woods** Runoff Area=2.590 ac 0.00% Impervious Runoff Depth>1.50"  
Flow Length=819' Tc=20.4 min CN=66 Runoff=3.18 cfs 0.324 af

**Subcatchment P6: Millstone Drive Entrance** Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>2.35"  
Flow Length=325' Tc=5.7 min CN=77 Runoff=0.94 cfs 0.063 af

**Reach 1R: Barbara Jean St** Inflow=6.38 cfs 0.588 af  
Outflow=6.38 cfs 0.588 af

**Reach 2R: Grist Mill Rd** Inflow=1.57 cfs 0.166 af  
Outflow=1.57 cfs 0.166 af

**Reach 3R: Pleasant St** Inflow=3.18 cfs 0.324 af  
Outflow=3.18 cfs 0.324 af

**Pond 1P: Detention Basin** Peak Elev=331.02' Storage=22,542 cf Inflow=12.43 cfs 0.956 af  
Discarded=0.88 cfs 0.602 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.88 cfs 0.602 af

**Pond 2P: Subsurface Recharge** Peak Elev=328.96' Storage=921 cf Inflow=0.94 cfs 0.063 af  
Discarded=0.14 cfs 0.063 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.063 af

**Total Runoff Area = 14.880 ac Runoff Volume = 2.097 af Average Runoff Depth = 1.69"**  
**90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac**

**Summary for Subcatchment P1: Runoff to Barbara Jean St**

Runoff = 6.38 cfs @ 12.24 hrs, Volume= 0.588 af, Depth> 1.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b>
					Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b>
					Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment P2: Lawn/Woods**

Runoff = 1.57 cfs @ 12.29 hrs, Volume= 0.166 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
0.320	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 1.340	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
1.900	59	Weighted Average
1.840		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.22		<b>Sheet Flow, Segment 1</b>
					Grass: Short n= 0.150 P2= 3.00"
14.6	435	0.0050	0.49		<b>Shallow Concentrated Flow, Segment 2</b>
					Short Grass Pasture Kv= 7.0 fps
18.3	485	Total			



**Summary for Subcatchment P3: Lawn/Woods**

Runoff = 4.63 cfs @ 12.15 hrs, Volume= 0.366 af, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
0.910	77	Woods, Good, HSG D
0.710	55	Woods, Good, HSG B
* 0.170	80	Lawn, Good, HSG D
* 1.260	61	Lawn, Good, HSG B
3.050	65	Weighted Average
3.050		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	222	0.2070	2.27		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	<b>Trap/Vee/Rect Channel Flow, Segment 4</b> Bot.W=5.00' D=2.00' Z= 3.0 ' Top.W=17.00' n= 0.033
0.2	40	0.3300	4.02		<b>Shallow Concentrated Flow, Segment 6</b> Short Grass Pasture Kv= 7.0 fps
9.9	901	Total			

**Summary for Subcatchment P4: Millstone Drive**

Runoff = 7.83 cfs @ 12.14 hrs, Volume= 0.590 af, Depth> 2.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
* 1.990	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.240	75	Weighted Average
1.990		Pervious Area
1.250		Impervious Area

**G-353-POST-12-11-15**

Type III 24-hr 10-YR Rainfall=4.89"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		<b>Shallow Concentrated Flow, Segment 2</b> Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 4</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

**Summary for Subcatchment P5: Lawn/Woods**

Runoff = 3.18 cfs @ 12.31 hrs, Volume= 0.324 af, Depth&gt; 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

Area (ac)	CN	Description
0.380	70	Woods, Good, HSG C
0.780	77	Woods, Good, HSG D
0.470	55	Woods, Good, HSG B
* 0.960	61	Lawn, Good, HSG B
2.590	66	Weighted Average
2.590		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
4.6	530	0.1470	1.92		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.1	239	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
20.4	819	Total			

**Summary for Subcatchment P6: Millstone Drive Entrance**

Runoff = 0.94 cfs @ 12.09 hrs, Volume= 0.063 af, Depth&gt; 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.89"

**G-353-POST-12-11-15**

Type III 24-hr 10-YR Rainfall=4.89"

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Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		<b>Sheet Flow, Segment 2</b> Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 3</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 1.87" for 10-YR event  
 Inflow = 6.38 cfs @ 12.24 hrs, Volume= 0.588 af  
 Outflow = 6.38 cfs @ 12.24 hrs, Volume= 0.588 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 8.190 ac, 16.00% Impervious, Inflow Depth > 0.24" for 10-YR event  
 Inflow = 1.57 cfs @ 12.29 hrs, Volume= 0.166 af  
 Outflow = 1.57 cfs @ 12.29 hrs, Volume= 0.166 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 2.910 ac, 5.84% Impervious, Inflow Depth > 1.34" for 10-YR event  
 Inflow = 3.18 cfs @ 12.31 hrs, Volume= 0.324 af  
 Outflow = 3.18 cfs @ 12.31 hrs, Volume= 0.324 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Pond 1P: Detention Basin**

Inflow Area = 6.290 ac, 19.87% Impervious, Inflow Depth > 1.82" for 10-YR event  
 Inflow = 12.43 cfs @ 12.14 hrs, Volume= 0.956 af  
 Outflow = 0.88 cfs @ 14.78 hrs, Volume= 0.602 af, Atten= 93%, Lag= 158.2 min  
 Discarded = 0.88 cfs @ 14.78 hrs, Volume= 0.602 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 331.02' @ 14.78 hrs Surf.Area= 15,692 sf Storage= 22,542 cf

Plug-Flow detention time= 211.0 min calculated for 0.600 af (63% of inflow)  
 Center-of-Mass det. time= 134.7 min ( 943.6 - 808.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	329.00'	99,247 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	1,187	0	0
330.00	13,743	7,465	7,465
332.00	17,549	31,292	38,757
334.00	21,044	38,593	77,350
335.00	22,749	21,897	99,247

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	<b>12.0" x 156.0' long Culvert</b> RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 327.22' S= 0.0050 ' Cc= 0.900 n= 0.013
#2	Device 1	332.00'	<b>2.00' x 2.00' Horiz. Orifice/Grate</b> Limited to weir flow C= 0.600
#3	Secondary	334.50'	<b>15.0' long x 15.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Discarded	329.00'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.88 cfs @ 14.78 hrs HW=331.02' (Free Discharge)

↑ **4=Exfiltration** (Exfiltration Controls 0.88 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↑ **1=Culvert** (Passes 0.00 cfs of 2.32 cfs potential flow)

↑ **2=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**G-353-POST-12-11-15**

Type III 24-hr 10-YR Rainfall=4.89"

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**Summary for Pond 2P: Subsurface Recharge**

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 2.35" for 10-YR event  
 Inflow = 0.94 cfs @ 12.09 hrs, Volume= 0.063 af  
 Outflow = 0.14 cfs @ 11.80 hrs, Volume= 0.063 af, Atten= 85%, Lag= 0.0 min  
 Discarded = 0.14 cfs @ 11.80 hrs, Volume= 0.063 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 328.96' @ 12.63 hrs Surf.Area= 2,520 sf Storage= 921 cf

Plug-Flow detention time= 51.2 min calculated for 0.063 af (100% of inflow)  
 Center-of-Mass det. time= 50.4 min ( 844.4 - 794.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	328.05'	3,832 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 11,340 cf Overall - 1,760 cf Embedded = 9,580 cf x 40.0% Voids
#2	329.70'	782 cf	<b>12.0"D x 166.00"L Horizontal Cylinder</b> x 6 Inside #1 1,760 cf Overall - 3.0" Wall Thickness = 782 cf
		4,614 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.05	2,520	0	0
332.55	2,520	11,340	11,340

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.05'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	332.50'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.14 cfs @ 11.80 hrs HW=328.10' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.05' (Free Discharge)  
 ↳ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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**POST DEVELOPMENT 25 YEAR STORM EVENT**

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**G-353-POST-12-11-15**

Type III 24-hr 25-YR Rainfall=6.18"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>2.81"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=9.69 cfs 0.887 af

**Subcatchment P2: Lawn/Woods** Runoff Area=1.900 ac 3.16% Impervious Runoff Depth>1.77"  
Flow Length=485' Tc=18.3 min CN=59 Runoff=2.84 cfs 0.280 af

**Subcatchment P3: Lawn/Woods** Runoff Area=3.050 ac 0.00% Impervious Runoff Depth>2.28"  
Flow Length=901' Tc=9.9 min CN=65 Runoff=7.53 cfs 0.580 af

**Subcatchment P4: Millstone Drive** Runoff Area=3.240 ac 38.58% Impervious Runoff Depth>3.20"  
Flow Length=647' Tc=9.4 min CN=75 Runoff=11.44 cfs 0.864 af

**Subcatchment P5: Lawn/Woods** Runoff Area=2.590 ac 0.00% Impervious Runoff Depth>2.36"  
Flow Length=819' Tc=20.4 min CN=66 Runoff=5.11 cfs 0.509 af

**Subcatchment P6: Millstone Drive Entrance** Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>3.40"  
Flow Length=325' Tc=5.7 min CN=77 Runoff=1.34 cfs 0.091 af

**Reach 1R: Barbara Jean St** Inflow=9.69 cfs 0.887 af  
Outflow=9.69 cfs 0.887 af

**Reach 2R: Grist Mill Rd** Inflow=2.84 cfs 0.280 af  
Outflow=2.84 cfs 0.280 af

**Reach 3R: Pleasant St** Inflow=5.11 cfs 0.509 af  
Outflow=5.11 cfs 0.509 af

**Pond 1P: Detention Basin** Peak Elev=331.98' Storage=38,480 cf Inflow=18.94 cfs 1.444 af  
Discarded=0.98 cfs 0.698 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.98 cfs 0.698 af

**Pond 2P: Subsurface Recharge** Peak Elev=329.65' Storage=1,555 cf Inflow=1.34 cfs 0.091 af  
Discarded=0.14 cfs 0.090 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.090 af

**Total Runoff Area = 14.880 ac Runoff Volume = 3.211 af Average Runoff Depth = 2.59"**  
**90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac**

**Summary for Subcatchment P1: Runoff to Barbara Jean St**

Runoff = 9.69 cfs @ 12.24 hrs, Volume= 0.887 af, Depth&gt; 2.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b>
					Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b>
					Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment P2: Lawn/Woods**

Runoff = 2.84 cfs @ 12.27 hrs, Volume= 0.280 af, Depth&gt; 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
0.320	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 1.340	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
1.900	59	Weighted Average
1.840		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.22		<b>Sheet Flow, Segment 1</b>
					Grass: Short n= 0.150 P2= 3.00"
14.6	435	0.0050	0.49		<b>Shallow Concentrated Flow, Segment 2</b>
					Short Grass Pasture Kv= 7.0 fps
18.3	485	Total			



**G-353-POST-12-11-15**

Type III 24-hr 25-YR Rainfall=6.18"

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**Summary for Subcatchment P3: Lawn/Woods**

Runoff = 7.53 cfs @ 12.15 hrs, Volume= 0.580 af, Depth&gt; 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
0.910	77	Woods, Good, HSG D
0.710	55	Woods, Good, HSG B
* 0.170	80	Lawn, Good, HSG D
* 1.260	61	Lawn, Good, HSG B
3.050	65	Weighted Average
3.050		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	222	0.2070	2.27		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	<b>Trap/Vee/Rect Channel Flow, Segment 4</b> Bot.W=5.00' D=2.00' Z= 3.0 ' Top.W=17.00' n= 0.033
0.2	40	0.3300	4.02		<b>Shallow Concentrated Flow, Segment 6</b> Short Grass Pasture Kv= 7.0 fps
9.9	901	Total			

**Summary for Subcatchment P4: Millstone Drive**

Runoff = 11.44 cfs @ 12.14 hrs, Volume= 0.864 af, Depth&gt; 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
* 1.990	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.240	75	Weighted Average
1.990		Pervious Area
1.250		Impervious Area

**G-353-POST-12-11-15**

Type III 24-hr 25-YR Rainfall=6.18"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		<b>Shallow Concentrated Flow, Segment 2</b> Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 4</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

**Summary for Subcatchment P5: Lawn/Woods**

Runoff = 5.11 cfs @ 12.30 hrs, Volume= 0.509 af, Depth&gt; 2.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

Area (ac)	CN	Description
0.380	70	Woods, Good, HSG C
0.780	77	Woods, Good, HSG D
0.470	55	Woods, Good, HSG B
* 0.960	61	Lawn, Good, HSG B
2.590	66	Weighted Average
2.590		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
4.6	530	0.1470	1.92		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.1	239	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
20.4	819	Total			

**Summary for Subcatchment P6: Millstone Drive Entrance**

Runoff = 1.34 cfs @ 12.09 hrs, Volume= 0.091 af, Depth&gt; 3.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.18"

**G-353-POST-12-11-15**

Type III 24-hr 25-YR Rainfall=6.18"

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Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		<b>Sheet Flow, Segment 2</b> Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 3</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 2.81" for 25-YR event  
 Inflow = 9.69 cfs @ 12.24 hrs, Volume= 0.887 af  
 Outflow = 9.69 cfs @ 12.24 hrs, Volume= 0.887 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 8.190 ac, 16.00% Impervious, Inflow Depth > 0.41" for 25-YR event  
 Inflow = 2.84 cfs @ 12.27 hrs, Volume= 0.280 af  
 Outflow = 2.84 cfs @ 12.27 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 2.910 ac, 5.84% Impervious, Inflow Depth > 2.10" for 25-YR event  
 Inflow = 5.11 cfs @ 12.30 hrs, Volume= 0.509 af  
 Outflow = 5.11 cfs @ 12.30 hrs, Volume= 0.509 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Pond 1P: Detention Basin**

Inflow Area = 6.290 ac, 19.87% Impervious, Inflow Depth > 2.76" for 25-YR event  
 Inflow = 18.94 cfs @ 12.14 hrs, Volume= 1.444 af  
 Outflow = 0.98 cfs @ 15.56 hrs, Volume= 0.698 af, Atten= 95%, Lag= 205.2 min  
 Discarded = 0.98 cfs @ 15.56 hrs, Volume= 0.698 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 331.98' @ 15.56 hrs Surf.Area= 17,519 sf Storage= 38,480 cf

Plug-Flow detention time= 218.3 min calculated for 0.696 af (48% of inflow)  
 Center-of-Mass det. time= 134.2 min ( 934.1 - 799.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	329.00'	99,247 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	1,187	0	0
330.00	13,743	7,465	7,465
332.00	17,549	31,292	38,757
334.00	21,044	38,593	77,350
335.00	22,749	21,897	99,247

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	<b>12.0" x 156.0' long Culvert</b> RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 327.22' S= 0.0050 '/' Cc= 0.900 n= 0.013
#2	Device 1	332.00'	<b>2.00' x 2.00' Horiz. Orifice/Grate</b> Limited to weir flow C= 0.600
#3	Secondary	334.50'	<b>15.0' long x 15.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Discarded	329.00'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.98 cfs @ 15.56 hrs HW=331.98' (Free Discharge)

↑ **4=Exfiltration** (Exfiltration Controls 0.98 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↑ **1=Culvert** (Passes 0.00 cfs of 2.32 cfs potential flow)

↑ **2=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Summary for Pond 2P: Subsurface Recharge**

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 3.40" for 25-YR event  
 Inflow = 1.34 cfs @ 12.09 hrs, Volume= 0.091 af  
 Outflow = 0.14 cfs @ 11.70 hrs, Volume= 0.090 af, Atten= 90%, Lag= 0.0 min  
 Discarded = 0.14 cfs @ 11.70 hrs, Volume= 0.090 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 329.65' @ 12.94 hrs Surf.Area= 2,520 sf Storage= 1,555 cf

Plug-Flow detention time= 96.6 min calculated for 0.090 af (99% of inflow)  
 Center-of-Mass det. time= 95.5 min ( 881.1 - 785.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	328.05'	3,832 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 11,340 cf Overall - 1,760 cf Embedded = 9,580 cf x 40.0% Voids
#2	329.70'	782 cf	<b>12.0"D x 166.00"L Horizontal Cylinder</b> x 6 Inside #1 1,760 cf Overall - 3.0" Wall Thickness = 782 cf
		4,614 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.05	2,520	0	0
332.55	2,520	11,340	11,340

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.05'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	332.50'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.14 cfs @ 11.70 hrs HW=328.11' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.05' (Free Discharge)  
 ↳ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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## **POST DEVELOPMENT 100 YEAR STORM EVENT**

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**G-353-POST-12-11-15**

Type III 24-hr 100-YR Rainfall=8.85"

Prepared by J.M. Grenier Associates Inc.

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P1: Runoff to Barbara Jean St** Runoff Area=3.780 ac 0.00% Impervious Runoff Depth>4.97"  
Flow Length=1,024' Tc=16.7 min CN=71 Runoff=17.01 cfs 1.564 af

**Subcatchment P2: Lawn/Woods** Runoff Area=1.900 ac 3.16% Impervious Runoff Depth>3.55"  
Flow Length=485' Tc=18.3 min CN=59 Runoff=5.91 cfs 0.562 af

**Subcatchment P3: Lawn/Woods** Runoff Area=3.050 ac 0.00% Impervious Runoff Depth>4.26"  
Flow Length=901' Tc=9.9 min CN=65 Runoff=14.20 cfs 1.084 af

**Subcatchment P4: Millstone Drive** Runoff Area=3.240 ac 38.58% Impervious Runoff Depth>5.45"  
Flow Length=647' Tc=9.4 min CN=75 Runoff=19.22 cfs 1.473 af

**Subcatchment P5: Lawn/Woods** Runoff Area=2.590 ac 0.00% Impervious Runoff Depth>4.37"  
Flow Length=819' Tc=20.4 min CN=66 Runoff=9.52 cfs 0.943 af

**Subcatchment P6: Millstone Drive Entrance** Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>5.70"  
Flow Length=325' Tc=5.7 min CN=77 Runoff=2.21 cfs 0.152 af

**Reach 1R: Barbara Jean St** Inflow=17.01 cfs 1.564 af  
Outflow=17.01 cfs 1.564 af

**Reach 2R: Grist Mill Rd** Inflow=11.24 cfs 1.484 af  
Outflow=11.24 cfs 1.484 af

**Reach 3R: Pleasant St** Inflow=9.52 cfs 0.943 af  
Outflow=9.52 cfs 0.943 af

**Pond 1P: Detention Basin** Peak Elev=332.76' Storage=52,555 cf Inflow=33.38 cfs 2.557 af  
Discarded=1.05 cfs 0.788 af Primary=5.48 cfs 0.922 af Secondary=0.00 cfs 0.000 af Outflow=6.53 cfs 1.710 af

**Pond 2P: Subsurface Recharge** Peak Elev=331.08' Storage=3,133 cf Inflow=2.21 cfs 0.152 af  
Discarded=0.14 cfs 0.118 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.118 af

**Total Runoff Area = 14.880 ac Runoff Volume = 5.777 af Average Runoff Depth = 4.66"**  
**90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac**

**Summary for Subcatchment P1: Runoff to Barbara Jean St**

Runoff = 17.01 cfs @ 12.23 hrs, Volume= 1.564 af, Depth> 4.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
1.100	70	Woods, Good, HSG C
1.990	77	Woods, Good, HSG D
0.690	55	Woods, Good, HSG B
3.780	71	Weighted Average
3.780		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1200	0.13		<b>Sheet Flow, Segment 1</b>
					Woods: Light underbrush n= 0.400 P2= 3.00"
10.5	974	0.0950	1.54		<b>Shallow Concentrated Flow, Segment 2</b>
					Woodland Kv= 5.0 fps
16.7	1,024	Total			

**Summary for Subcatchment P2: Lawn/Woods**

Runoff = 5.91 cfs @ 12.26 hrs, Volume= 0.562 af, Depth> 3.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
0.320	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 1.340	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
1.900	59	Weighted Average
1.840		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.22		<b>Sheet Flow, Segment 1</b>
					Grass: Short n= 0.150 P2= 3.00"
14.6	435	0.0050	0.49		<b>Shallow Concentrated Flow, Segment 2</b>
					Short Grass Pasture Kv= 7.0 fps
18.3	485	Total			



**Summary for Subcatchment P3: Lawn/Woods**

Runoff = 14.20 cfs @ 12.14 hrs, Volume= 1.084 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
0.910	77	Woods, Good, HSG D
0.710	55	Woods, Good, HSG B
* 0.170	80	Lawn, Good, HSG D
* 1.260	61	Lawn, Good, HSG B
3.050	65	Weighted Average
3.050		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.1000	0.12		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	222	0.2070	2.27		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	<b>Trap/Vee/Rect Channel Flow, Segment 4</b> Bot.W=5.00' D=2.00' Z= 3.0 ' Top.W=17.00' n= 0.033
0.2	40	0.3300	4.02		<b>Shallow Concentrated Flow, Segment 6</b> Short Grass Pasture Kv= 7.0 fps
9.9	901	Total			

**Summary for Subcatchment P4: Millstone Drive**

Runoff = 19.22 cfs @ 12.13 hrs, Volume= 1.473 af, Depth> 5.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
* 1.990	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.240	75	Weighted Average
1.990		Pervious Area
1.250		Impervious Area

**G-353-POST-12-11-15**

Type III 24-hr 100-YR Rainfall=8.85"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		<b>Shallow Concentrated Flow, Segment 2</b> Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 4</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

**Summary for Subcatchment P5: Lawn/Woods**

Runoff = 9.52 cfs @ 12.29 hrs, Volume= 0.943 af, Depth&gt; 4.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

Area (ac)	CN	Description
0.380	70	Woods, Good, HSG C
0.780	77	Woods, Good, HSG D
0.470	55	Woods, Good, HSG B
* 0.960	61	Lawn, Good, HSG B
2.590	66	Weighted Average
2.590		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		<b>Sheet Flow, Segment 1</b> Woods: Light underbrush n= 0.400 P2= 3.00"
4.6	530	0.1470	1.92		<b>Shallow Concentrated Flow, Segment 2</b> Woodland Kv= 5.0 fps
3.1	239	0.0330	1.27		<b>Shallow Concentrated Flow, Segment 3</b> Short Grass Pasture Kv= 7.0 fps
20.4	819	Total			

**Summary for Subcatchment P6: Millstone Drive Entrance**

Runoff = 2.21 cfs @ 12.09 hrs, Volume= 0.152 af, Depth&gt; 5.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=8.85"

**G-353-POST-12-11-15**

Type III 24-hr 100-YR Rainfall=8.85"

Prepared by J.M. Grenier Associates Inc.

Printed 12/16/2015

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Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		<b>Sheet Flow, Segment 1</b> Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		<b>Sheet Flow, Segment 2</b> Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		<b>Shallow Concentrated Flow, Segment 3</b> Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	<b>Circular Channel (pipe), Segment 3</b> Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

**Summary for Reach 1R: Barbara Jean St**

Inflow Area = 3.780 ac, 0.00% Impervious, Inflow Depth > 4.97" for 100-YR event  
 Inflow = 17.01 cfs @ 12.23 hrs, Volume= 1.564 af  
 Outflow = 17.01 cfs @ 12.23 hrs, Volume= 1.564 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 2R: Grist Mill Rd**

Inflow Area = 8.190 ac, 16.00% Impervious, Inflow Depth > 2.17" for 100-YR event  
 Inflow = 11.24 cfs @ 12.32 hrs, Volume= 1.484 af  
 Outflow = 11.24 cfs @ 12.32 hrs, Volume= 1.484 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Reach 3R: Pleasant St**

Inflow Area = 2.910 ac, 5.84% Impervious, Inflow Depth > 3.89" for 100-YR event  
 Inflow = 9.52 cfs @ 12.29 hrs, Volume= 0.943 af  
 Outflow = 9.52 cfs @ 12.29 hrs, Volume= 0.943 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Pond 1P: Detention Basin**

Inflow Area = 6.290 ac, 19.87% Impervious, Inflow Depth > 4.88" for 100-YR event  
 Inflow = 33.38 cfs @ 12.14 hrs, Volume= 2.557 af  
 Outflow = 6.53 cfs @ 12.64 hrs, Volume= 1.710 af, Atten= 80%, Lag= 30.3 min  
 Discarded = 1.05 cfs @ 12.64 hrs, Volume= 0.788 af  
 Primary = 5.48 cfs @ 12.64 hrs, Volume= 0.922 af  
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 332.76' @ 12.64 hrs Surf.Area= 18,873 sf Storage= 52,555 cf

Plug-Flow detention time= 138.3 min calculated for 1.710 af (67% of inflow)  
 Center-of-Mass det. time= 68.3 min ( 855.6 - 787.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	329.00'	99,247 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	1,187	0	0
330.00	13,743	7,465	7,465
332.00	17,549	31,292	38,757
334.00	21,044	38,593	77,350
335.00	22,749	21,897	99,247

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	<b>12.0" x 156.0' long Culvert</b> RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 327.22' S= 0.0050 '/' Cc= 0.900 n= 0.013
#2	Device 1	332.00'	<b>2.00' x 2.00' Horiz. Orifice/Grate</b> Limited to weir flow C= 0.600
#3	Secondary	334.50'	<b>15.0' long x 15.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Discarded	329.00'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=1.05 cfs @ 12.64 hrs HW=332.76' (Free Discharge)

↳ **4=Exfiltration** (Exfiltration Controls 1.05 cfs)

**Primary OutFlow** Max=5.48 cfs @ 12.64 hrs HW=332.76' (Free Discharge)

↳ **1=Culvert** (Barrel Controls 5.48 cfs @ 6.98 fps)

↳ **2=Orifice/Grate** (Passes 5.48 cfs of 16.76 cfs potential flow)

**Secondary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=329.00' (Free Discharge)

↳ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Summary for Pond 2P: Subsurface Recharge**

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 5.70" for 100-YR event  
 Inflow = 2.21 cfs @ 12.09 hrs, Volume= 0.152 af  
 Outflow = 0.14 cfs @ 11.30 hrs, Volume= 0.118 af, Atten= 94%, Lag= 0.0 min  
 Discarded = 0.14 cfs @ 11.30 hrs, Volume= 0.118 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 331.08' @ 13.85 hrs Surf.Area= 2,520 sf Storage= 3,133 cf

Plug-Flow detention time= 175.7 min calculated for 0.118 af (78% of inflow)  
 Center-of-Mass det. time= 118.8 min ( 892.2 - 773.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	328.05'	3,832 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 11,340 cf Overall - 1,760 cf Embedded = 9,580 cf x 40.0% Voids
#2	329.70'	782 cf	<b>12.0"D x 166.00'L Horizontal Cylinder</b> x 6 Inside #1 1,760 cf Overall - 3.0" Wall Thickness = 782 cf
		4,614 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.05	2,520	0	0
332.55	2,520	11,340	11,340

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.05'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	332.50'	<b>30.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.14 cfs @ 11.30 hrs HW=328.10' (Free Discharge)  
 ↑ **1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.05' (Free Discharge)  
 ↑ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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## **STORMWATER MANAGEMENT FORM**

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# Checklist for Stormwater Report

## A. Introduction

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.<sup>1</sup> This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8<sup>2</sup>
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

<sup>1</sup> The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

<sup>2</sup> For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

### Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

### Checklist

**Project Type:** Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment





# Checklist for Stormwater Report

## Checklist (continued)

**LID Measures:** Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): \_\_\_\_\_

### Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



# Checklist for Stormwater Report

## Checklist (continued)

### Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

### Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - ☒ Static
  - ☐ Simple Dynamic
  - ☐ Dynamic Field<sup>1</sup>
- ☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
  - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
  - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

## Checklist (continued)

### Standard 3: Recharge (continued)

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

### Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
  - Provisions for storing materials and waste products inside or under cover;
  - Vehicle washing controls;
  - Requirements for routine inspections and maintenance of stormwater BMPs;
  - Spill prevention and response plans;
  - Provisions for maintenance of lawns, gardens, and other landscaped areas;
  - Requirements for storage and use of fertilizers, herbicides, and pesticides;
  - Pet waste management provisions;
  - Provisions for operation and management of septic systems;
  - Provisions for solid waste management;
  - Snow disposal and plowing plans relative to Wetland Resource Areas;
  - Winter Road Salt and/or Sand Use and Storage restrictions;
  - Street sweeping schedules;
  - Provisions for prevention of illicit discharges to the stormwater management system;
  - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
  - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
  - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
  - ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
    - ☐ is within the Zone II or Interim Wellhead Protection Area
    - ☐ is near or to other critical areas
    - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
    - ☐ involves runoff from land uses with higher potential pollutant loads.
  - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
  - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



# Checklist for Stormwater Report

## Checklist (continued)

### Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
  - ☒ The ½" or 1" Water Quality Volume or
  - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

### Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted *prior to* the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does *not* cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has *not* been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

### Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



# Checklist for Stormwater Report

## Checklist (continued)

### Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
  - ☐ Limited Project
  - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
  - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
  - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
  - ☐ Bike Path and/or Foot Path
  - ☐ Redevelopment Project
  - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
  - Construction Period Operation and Maintenance Plan;
  - Names of Persons or Entity Responsible for Plan Compliance;
  - Construction Period Pollution Prevention Measures;
  - Erosion and Sedimentation Control Plan Drawings;
  - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
  - Vegetation Planning;
  - Site Development Plan;
  - Construction Sequencing Plan;
  - Sequencing of Erosion and Sedimentation Controls;
  - Operation and Maintenance of Erosion and Sedimentation Controls;
  - Inspection Schedule;
  - Maintenance Schedule;
  - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



# Checklist for Stormwater Report

## Checklist (continued)

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

### Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - ☒ Name of the stormwater management system owners;
  - ☒ Party responsible for operation and maintenance;
  - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
  - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
  - ☐ Description and delineation of public safety features;
  - ☐ Estimated operation and maintenance budget; and
  - ☐ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

### Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

# STORMWATER NARRATIVE

## Design Methods and Objectives

The design of this residential subdivision has been prepared in accordance with Stormwater Management Standards as outlined in the Stormwater Management Handbook. In particular, the site has been designed to ensure:

1. No new stormwater conveyances will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. All pavement runoff from the development is routed through infiltration basins or a subsurface recharge system.
2. Stormwater management systems are designed so that the post-development peak discharge rate does not exceed pre-development peak discharge rates. Drainage calculations demonstrate that the peak rate of runoff is reduced in the post development condition through the use of an infiltration basin.
3. Loss of annual recharge to ground water is minimized through the use of an infiltration basin and subsurface recharge system. The basin and recharge, as designed will provide 42,005 cu.ft. of storage volume which is greater than the required recharge volume required for the combination of "A" and "B" soils, 1,863 cu.ft.
4. Stormwater management systems are designed to remove 80% TSS. The use of a deep sump catch basin, and infiltration basin provide a total of 85% TSS removal for runoff associated with Greystone Drive. The combination of a deep sump catch basin, water quality inlet and subsurface recharge provide a total of 89% TSS removal including 44% pretreatment for runoff associated with Millstone Drive.
5. The use of the site for a residential subdivision is not a risk for producing higher pollutant loads. Notwithstanding, the treatment of runoff from this portion of the site will ensure treatment of any potential pollutants.
6. This site is not within a Zone II or interim wellhead protection area.
7. This site is a new development and redevelopment and stormwater management guidelines are met.
8. For construction related activities, an operation and maintenance plan has been incorporated into the Stormwater Management Report to ensure that a protocol for runoff control is in place prior to any construction activities.
9. The operation and maintenance plan as provided provides a protocol to ensure that the stormwater management system will function as designed.
10. Prior to any construction related activities taking place, a certification regarding illicit discharges will be submitted.

# **STORMWATER MANAGEMENT CALCULATIONS**

## **Total Impervious Area**

Pavement:	42,751 sq.ft. /0.981 ac.
Buildings	19,500 sq.ft. /0.448 ac.
Total	62,251 sq.ft. /1.429 ac.

## **Standard #3: Recharge to Groundwater**

Recharge Required:  $(0.60''/12' * 2,266 \text{ sq. ft. "A" impervious} = 113 \text{ cu.ft.}$   
 $+(0.35''/12' * 59,985 \text{ sq. ft. "B" impervious} = \underline{1,750 \text{ cu.ft.}}$   
1,863 cu.ft.

Recharge Provided: 38,757 cu. ft. @ elev. 332.00 in infiltration basin  
3,248 cu. ft. @ elev. 331.47 in subsurface recharge (all runoff recharged)  
42,005 cu. ft.

## **Drawdown within 72 hours**

Time:  $(38,757 \text{ cu.ft.}/(2.41''/\text{hr} * (1'/12'') * 17,549 \text{ sq.ft.})) = 11.0 \text{ hours in infiltration basin}$   
 $(3,248 \text{ cu.ft.}/(2.41''/\text{hr} * (1'/12'') * 2,310 \text{ sq.ft.})) = 7.0 \text{ hours in subsurface recharge}$

## **Standard #4: Water Quality**

Treatment Volume Required :  $(0.5''/12') * 42,751 \text{ sq. ft.} = 1,781 \text{ cu. ft.}$   
Treatment Volume Provided: 38,757 cu. ft. @ elev. 332.00 in infiltration basin  
3,248 cu. ft. @ elev. 331.47 in subsurface recharge (all runoff recharged)  
42,005 cu. ft.

Water Quality Inlet Treatment Required:  $0.149 \text{ ac. pavement} * 400 \text{ cu.ft./ac} = 60 \text{ cu.ft.}$   
Water Quality Inlet Treatment Provided:  $5 \text{ ft.} * 3 \text{ ft.} * 4 \text{ ft} = 60 \text{ cu.ft.}$

## **Forebay Sizing**

Forebay Treatment Volume Required:  $(0.1''/12') * 35,159 \text{ sq. ft.} = 293 \text{ cu. ft.}$   
Forebay Treatment Volume Provided: 4,424 cu. ft. @ elev. 331.0 in forebay

## **Riprap Apron Sizing**

$$L = (k_2 * q) / (D^{1/2}) = (3 * 10.7 \text{ cfs}) / (2.0 \text{ ft}^{1/2}) = 22.7 \text{ ft}$$

$$W1 = 3 * D = 3 * 2.0 \text{ ft} = 6 \text{ ft}$$

$$W2 = (3 * D) + (0.4 * L) = (3 * 2.0 \text{ ft}) + (0.4 * 22.7 \text{ ft}) = 15.1 \text{ ft}$$

$$D_{50} = 0.2D(q/(g^{1/2} * D^{2.5})(D/TW) = (0.2 * 2.0 \text{ ft}) * (10.7 \text{ cfs} / (32.2 \text{ ft/s}^{1/2} * 2.0^{2.5})) * (2.0 \text{ ft} / 0.5 \text{ ft})$$
$$= 0.4 * 0.333 * 1.0 = 0.133 \text{ ft} = 1.6 \text{ in}$$



## INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: "Gristmill Village" Grafton - Millstone Drive

TSS Removal Calculation Worksheet					
B	C	D	E	F	
BMP <sup>1</sup>	TSS Removal Rate <sup>1</sup>	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)	
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75	
Infiltration Basin	0.80	0.75	0.60	0.15	
	0.00	0.15	0.00	0.15	
	0.00	0.15	0.00	0.15	
	0.00	0.15	0.00	0.15	
<b>Total TSS Removal =</b>			85%	Separate Form Needs to be Completed for Each Outlet or BMP Train	

G-353

Project:

Prepared By:

Date: 7/13/2015

\*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet

must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

**INSTRUCTIONS:**

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: "Gristmill Village" Grafton - Millstone Drive Entrance

BMP <sup>1</sup>	C		D		E		F	
	TSS Removal Rate <sup>1</sup>		Starting TSS Load*		Removed (C*D)		Remaining Load (D-E)	
Deep Sump and Hooded Catch Basin	0.25		1.00		0.25		0.75	
Oil Grit Separator	0.25		0.75		0.19		0.56	
Subsurface Infiltration Structure	0.80		0.56		0.45		0.11	
	0.00		0.11		0.00		0.11	
	0.00		0.11		0.00		0.11	
<b>Total TSS Removal =</b>					89%		Separate Form Needs to be Completed for Each Outlet or BMP Train	

G-353

Project:

Prepared By:

Date: 7/13/2015

\*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet

must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Project: **G-353**  
Location: **Grafton, Massachusetts**

By: **DCT**  
Chkd: **JMG**

Date: **7/13/2015**  
Date: **7/13/2015**

### Catchment Watershed Areas

Design Storm: **25** year

WA: **cb-1**

	Area (Ac)		C		AxC		
Paved:	0.09	x	0.9	=	0.081	Overland Flow Time:	5 min.
Dense grass:	0.07	x	0.3	=	0.021	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	0.16	x	0.64	=	0.10	Flow (Q=AxCxi):	0.6 cfs

WA: **cb-2**

	Area (Ac)		C		AxC		
Paved:	0.08	x	0.9		0.072	Overland Flow Time:	5 min.
Dense grass:	0.08	x	0.3		0.024	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	0.16	x	0.60	=	0.10	Flow (Q=AxCxi):	0.6 cfs

WA: **cb-3**

	Area (Ac)		C		AxC		
Paved:	0.13	x	0.9		0.117	Overland Flow Time:	5 min.
Dense grass:	0.12	x	0.3		0.036	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	0.25	x	0.61	=	0.15	Flow (Q=AxCxi):	0.9 cfs

WA: **cb-4**

	Area (Ac)		C		AxC		
Paved:	0.13	x	0.9		0.117	Overland Flow Time:	5 min.
Dense grass:	0.27	x	0.3		0.081	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	0.40	x	0.50	=	0.198	Flow (Q=AxCxi):	1.2 cfs

WA: **cb-5**

	Area (Ac)		C		AxC		
Paved:	0.24	x	0.9		0.216	Overland Flow Time:	5 min.
Dense grass:	0.24	x	0.3		0.072	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	0.48	x	0.60	=	0.29	Flow (Q=AxCxi):	1.8 cfs

Project: **G-353**  
Location: **Grafton, Massachusetts**

By: **DCT**  
Chkd: **JMG**

Date: **7/13/2015**  
Date: **7/13/2015**

### Catchment Watershed Areas

Design Storm: **25** year

WA: **cb-6**

	Area (Ac)		C		AxC		
Paved:	0.24	x	0.9	=	0.216	Overland Flow Time:	5 min.
Dense grass:	0.31	x	0.3	=	0.093	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	0.55	x	0.56	=	0.31	Flow (Q=AxCxi):	1.9 cfs

WA: **cb-7**

	Area (Ac)		C		AxC		
Paved:	0.52	x	0.9		0.468	Overland Flow Time:	5 min.
Dense grass:	1.05	x	0.3		0.315	Intensity:	6.2 in/hr
<hr/>							
TOTAL:	1.57	x	0.50	=	0.78	Flow (Q=AxCxi):	4.8 cfs

WA:

	Area (Ac)		C		AxC		
Paved:		x				Overland Flow Time:	min.
Dense grass:		x				Intensity:	in/hr
<hr/>							
TOTAL:		x		=		Flow (Q=AxCxi):	cfs

WA:

	Area (Ac)		C		AxC		
Paved:		x				Overland Flow Time:	min.
Dense grass:		x				Intensity:	in/hr
<hr/>							
TOTAL:		x		=		Flow (Q=AxCxi):	cfs

WA:

	Area (Ac)		C		AxC		
Paved:		x				Overland Flow Time:	min.
Dense grass:		x				Intensity:	in/hr
<hr/>							
TOTAL:		x		=		Flow (Q=AxCxi):	cfs

PROJECT \_\_\_\_\_  
LOCATION \_\_\_\_\_  
JOB NO. \_\_\_\_\_  
FILE NO. \_\_\_\_\_

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## **OPERATION AND MAINTENANCE PLAN**

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## **OPERATION AND MAINTENANCE PLAN**

**"Gristmill Village"**

**Grafton**

**December 16, 2015**

The following are operation and maintenance instructions for both construction and post-development stormwater controls. The goal of these plans is to ensure that the stormwater system, as designed, will function properly during construction and for the future of the site. The developer of the parcel is Casa Builders & Developers Corp. Steve Venincasa is the contact person for work related to this project, and can be contacted at the following number: (508) 560-9440.

### **Construction Operation and Maintenance Plan:**

1. All erosion and sediment control devices installed prior to construction shall be inspected on a daily basis. Any deficiencies in the siltation fence shall be corrected immediately. Any accumulated silt shall be removed manually from the silt fence. Silt barrier should be inspected daily to ensure that there is no accumulation of sediments.
2. The most important aspects of controlling erosion and sedimentation are limiting the extent of disturbance and stabilizing surfaces as soon as possible. Of secondary importance in erosion control is limiting the size and length of the tributary drainage area within the work site and drainage structures. These fundamental principles shall be the key factor in the control of erosion on the site.
3. All disturbed surfaces shall be stabilized a minimum of 14 days after construction in any portion of the site has ceased or is temporarily halted unless additional construction is intended to be initiated within 21 days.
4. Hydroseeding and hay mulching shall be performed immediately after construction to minimize erosion damage. Newly seeded slopes shall be inspected every two weeks for the first few months to ensure that revegetation has occurred. Repairs and reseeded shall be performed immediately as the need arises.
5. The catch basin grate inlets are to be covered with plywood prior to the installation of pavement. This will prevent excess silt from accumulating in sumps and pipes. After pavement has been installed, a block and gravel inlet protection device shall be constructed surrounding the catch basin rims. This will keep silt out of the basins until the remainder of the site has been stabilized. The stone from the inlet protection shall be maintained frequently to ensure the highest degree of filtration.
6. As noted on the site plans, the basin shall be used to capture runoff from up-gradient areas during construction. However, the elevations of the basin shall be left one foot above proposed finish grades until all up-gradient areas are stabilized. At this time all accumulated sediments shall be removed from the basin area and the basin shall be excavated to the proposed finish grade.

7. At no time shall silt laden water be allowed to enter sensitive areas (wetlands, and off-site areas). Any runoff from disturbed surfaces shall be directed through settling basins and erosion control barriers prior to entering any sensitive areas.
8. At the completion of construction all areas are to be loamed and seeded to ensure that the site is stabilized.

**Post Development Operation and Maintenance Plan:**

1. Seeding and repairs shall be performed as required. Sediment and debris shall be removed at least once a year, typically in early spring prior to the commencement of the growing season.
2. The catch basins and water quality inlet on the site shall be inspected annually. Units shall be cleaned when accumulated sediments reach a depth of 6 inches. Accumulated sediment must be disposed of in accordance with applicable local state, and federal guidelines and regulations. The contractor will be responsible for the maintenance of the unit until such time as the site work is complete. The maintenance will then be the responsibility of the Town of Grafton
3. A contract with a licensed hauler shall be in place for maintenance of drainage structures to ensure the long term performance of the drainage system.
4. The infiltration basin shall be inspected after every major storm for the first 3 months and on a semi-annual basis after to ensure that it is functioning properly and that the vegetation is adequately established. It shall be inspected for the following: slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sediment. Regular maintenance shall include: regular mowing (not shorter than 4").
5. The drainage swales shall be inspected and mowed at least twice annually. Weeds and other vegetation shall be removed as necessary. The outlet shall be inspected twice annually and kept clear of debris. Sediment and debris shall be removed once a year. Grass height shall be between 3 and 6 inches.
6. The subsurface infiltration system shall be inspected after every major storm for the first 3 months to ensure proper function. It shall be inspected once per year after that. Water levels should be inspected and recorded for several days after a major storm event to check infiltration capacity.
7. The contractor will be responsible for the maintenance of all drainage structures and until such time as the site work is complete. The maintenance will then be the responsibility of Town of Grafton.
8. Operation and maintenance costs for the project are expected to be approximately \$5,500/year.



## **LONG TERM POLLUTION PREVENTION PLAN**

**"Gristmill Village"**

**Grafton**

**July 13, 2015**

This plan was developed in compliance with the Massachusetts Department of Environmental Protection Stormwater Requirements

### **Good Housekeeping**

The proposed site is designed to maintain high quality water treatment for all runoff. A general maintenance plan has been prepared and will be followed in a strict and complete manner as required.

### **Spill Prevention Plan**

No hazardous materials will be stored on site. However the flowing spill prevention plan will be incorporated into the Long Term Pollution Prevention Plan

1. Manufacturers recommended methods for spill cleanup will be clearly posted. Site personnel will be made aware of the procedures and location of the information and cleanup supplies.
2. Materials and equipment necessary for spill cleanup will be kept in the materials storage area. Equipment and materials will include, but is not limited to, brooms dust pans, mops, rags, gloves, sand and trash containers specifically for this purpose.
3. All spills will be cleaned up immediately after discovery.
4. The spill area will be kept will ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
5. Spills of toxic or hazardous material will be reported, regardless of size, to the Massachusetts Department of Environmental Protection (888) 304-1133
6. Should a spill occur, the spill prevention plan will be adjusted to include measures to prevent another spill and to cleanup the spill should another occur. A description of the spill along with the causes and cleanup measures will be included in the updated pollution prevention plan.
7. The construction superintendant responsible for daily operation on the site will be the spill prevention and cleanup coordinator. The superintendant will designate at least three site personnel to receive spill prevention cleanup training. The names of the responsible spill personnel will be posted in the material storage area.

### **Stormwater BMP Maintenance**

A full BMP maintenance plan has been prepared (see Operation & Maintenance Plan) in order to ensure that the stormwater management system will function properly and as designed.

### **Landscape and Lawn Maintenance**

Routine mowing and associated maintenance of all landscape features will occur weekly or as needed to prevent excessive growth of vegetation on site.

### **Solid Waste Maintenance**

Solid waste is handled on site and will comply with all local, state and federal requirements.

### **Roadway Maintenance**

roadways will be swept once a year to remove sand and other materials deposited on paved surfaces.

### **Training of Staff**

All personnel on site will be briefed on all requirements for implementing the Long Term Pollution Prevention Plan.

### **Emergency Contact for Long Term Pollution Prevention Plan**

J.M. Grenier Associates, Inc.  
787 Hartford Turnpike  
Shrewsbury, MA 01545  
(508) 845-2500

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## SOIL SURVEY DATA

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# Soil Map—Worcester County, Massachusetts, Southern Part



Map Scale: 1:5,210 if printed on A portrait (8.5" x 11") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84








































**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

8/8/2013  
Page 1 of 3

## MAP LEGEND

 Area of Interest (AOI)	 Spoil Area
 Soils	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
<b>Special Point Features</b>	 Special Line Features
 Blowout	<b>Water Features</b>
 Borrow Pit	 Streams and Canals
 Clay Spot	<b>Transportation</b>
 Closed Depression	 Rails
 Gravel Pit	 Interstate Highways
 Gravelly Spot	 US Routes
 Landfill	 Major Roads
 Lava Flow	 Local Roads
 Marsh or swamp	<b>Background</b>
 Mine or Quarry	 Aerial Photography
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Southern Part  
Survey Area Data: Version 5, Jan 30, 2007

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Worcester County, Massachusetts, Southern Part (MA615)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
102C	Chatfield-Hollis-Rock outcrop complex, 3 to 15 percent slopes	11.5	9.8%
245C	Hinckley sandy loam, 8 to 15 percent slopes	0.1	0.1%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	26.4	22.4%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	26.9	22.9%
420B	Canton fine sandy loam, 3 to 8 percent slopes	39.6	33.6%
420C	Canton fine sandy loam, 8 to 15 percent slopes	2.6	2.2%
600	Pits, gravel	10.6	9.0%
<b>Totals for Area of Interest</b>		<b>117.7</b>	<b>100.0%</b>

## FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

**On-Site Review**Deep Hole Number 1 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): \_\_\_\_\_

Land Use- VACANT Slope (%) 2-5 Surface Stones NONEVegetation- SCRUB/BRUSH

Landform \_\_\_\_\_

Position on Landscape (sketch on back) \_\_\_\_\_

Distances from:

Open Water Body >300 feetDrainage way- >100 feetPossible Wet Area >100 feetProperty Line- >30 feetDrinking Water Well >100 feet

Other -

**DEEP OBSERVATION HOLE LOG\***

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	A	SL			BOULDERS. GRAVELLY COBBLES VERIGATED MOTTLING@60" GRAVELLY BELOW MOTTLE
8-20	B	SL			
20-104	C	LS			

\*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >104"Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/AEstimated Seasonal High Ground Water: NONE

DEP APPROVED FORM – 12/07/95

## FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

**On-Site Review**Deep Hole Number 2 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): \_\_\_\_\_

Land Use- VACANT Slope (%) 2-5 Surface Stones NONEVegetation- SCRUB/BRUSH

Landform \_\_\_\_\_

Position on Landscape (sketch on back) \_\_\_\_\_

Distances from:

Open Water Body >300 feetDrainage way- >100 feetPossible Wet Area >100 feetProperty Line- >30 feetDrinking Water Well >100 feet

Other - \_\_\_\_\_

**DEEP OBSERVATION HOLE LOG\***

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
<b>0-10</b>	<b>A</b>	<b>SL</b>			<b>GRAVELLY, COBBLES STONY</b>
<b>10-24</b>	<b>B</b>	<b>SL</b>			
<b>24-90</b>	<b>C</b>	<b>LS</b>			

\*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >90"Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/AEstimated Seasonal High Ground Water: NONE

DEP APPROVED FORM – 12/07/95



FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

**On-Site Review**

Deep Hole Number 3 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): \_\_\_\_\_

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform \_\_\_\_\_

Position on Landscape (sketch on back) \_\_\_\_\_

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

**DEEP OBSERVATION HOLE LOG\***

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-10	A	SL			GRAVELLY, COBBLES STONY NO MOTTLES
10-26	B	SL			
24-90	C	LS			

\*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >90"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE

## FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

**On-Site Review**Deep Hole Number 4 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): \_\_\_\_\_

Land Use- VACANT Slope (%) 2-5 Surface Stones NONEVegetation- SCRUB/BRUSH

Landform \_\_\_\_\_

Position on Landscape (sketch on back) \_\_\_\_\_

Distances from:

Open Water Body >300 feetDrainage way- >100 feetPossible Wet Area >100 feetProperty Line- >30 feetDrinking Water Well >100 feet

Other -

**DEEP OBSERVATION HOLE LOG\***

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
<b>0-8</b>	<b>A</b>	<b>SL</b>			<b>GRAVELLY, COBBLES STONY VERIGATED MOTTLES @44"</b>
<b>8-32</b>	<b>B</b>	<b>SL</b>			
<b>32-104</b>	<b>C</b>	<b>LS</b>			

\*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >104"Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/AEstimated Seasonal High Ground Water: NONE

DEP APPROVED FORM – 12/07/95

## FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

**On-Site Review**Deep Hole Number 5 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): \_\_\_\_\_

Land Use- VACANT Slope (%) 2-5 Surface Stones NONEVegetation- SCRUB/BRUSH

Landform \_\_\_\_\_

Position on Landscape (sketch on back) \_\_\_\_\_

Distances from:

Open Water Body >300 feetDrainage way- >100 feetPossible Wet Area >100 feetProperty Line- >30 feetDrinking Water Well >100 feet

Other -

**DEEP OBSERVATION HOLE LOG\***

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
<b>0-10</b>	<b>A</b>	<b>SL</b>			GRAVELLY, COBBLES STONY NO MOTTLING SOME VERIGATED MOTTLING @40" NO SIGNS OF GROUNDWATER
<b>10-26</b>	<b>B</b>	<b>SL</b>			
<b>26-98</b>	<b>C</b>	<b>LS</b>			

\*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >98"Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/AEstimated Seasonal High Ground Water: NONE

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

**On-Site Review**Deep Hole Number 6 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): \_\_\_\_\_

Land Use- VACANT Slope (%) 2-5 Surface Stones NONEVegetation- SCRUB/BRUSH

Landform \_\_\_\_\_

Position on Landscape (sketch on back) \_\_\_\_\_

Distances from:

Open Water Body >300 feetDrainage way- >100 feetPossible Wet Area >100 feetProperty Line- >30 feetDrinking Water Well >100 feet

Other -

**DEEP OBSERVATION HOLE LOG\***

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
<b>0-6</b>	<b>A</b>	<b>SL</b>			<b>GRAVELLY, COBBLES STONY NO WEEP, WATER, REFUSAL</b>
<b>6-20</b>	<b>B</b>	<b>SL</b>			
<b>20-120</b>	<b>C</b>	<b>LS</b>			

\*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >120"Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/AEstimated Seasonal High Ground Water: NONE

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## **PRE AND POST DRAINAGE AREA PLANS**

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